June 9, 1887.

The Annual Meeting for the Election of Fellows was held this day.

Professor G. G. STOKES, D.C.L., President, in the Chair.

The Statutes relating to the election of Fellows having been read, Dr. J. H. Gladstone and Mr. G. J. Symons were, with the consent of the Society, nominated Scrutators to assist the Secretaries in examining the lists.

The votes of the Fellows present were then collected, and the following candidates were declared duly elected into the Society :—

Buchanan, John Young, M.A.
Cash, John Theodore, M.D.
Douglass, Sir James Nicholas, M.I.C.E.
Ewing, Prof. James Alfred, B.Sc.
Forbes, Prof. George, M.A.
Gowers, William Richard, M.D.
Kennedy, Prof. Alexander B. W., M.I.C.E.
King, George, M.B.
Kirk, Sir John, M.D.
Lodge, Prof. Oliver Joseph, D.Sc.
Milne, Prof. John, F.G.S.
Pickard-Cambridge, Rev. Octavius, M.A.
Snelus, George James, F.C.S.
Walsingham, Thomas, Lord.
Whitaker, William, B.A.

Thanks were given to the Scrutators.

June 16, 1887.

Professor G. G. STOKES, D.C.L., President, in the Chair.

The Right Hon. the Earl of Rosebery (elected 1886), Mr. H. C. Russell (elected 1886), Mr. John Young Buchanan, Dr. John Theodore Cash, Sir James Nicholas Douglass, Prof. James Alfred Ewing, Prof. George Forbes, Dr. William Richard Gowers, Prof. Alexander B. W. Kennedy, Sir John Kirk, Mr. George James Snelus, and Lord Walsingham, were admitted into the Society.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read :—

I. "On the Structure of the Mucilage Cells of *Blechnum occidentale* (L.) and *Osmunda regalis* (L.)"

By TOKUTARO ITO, F.L.S., and WALTER GARDINER, M.A. Communicated by Professor M. FOSTER, Sec. R.S. Received May 31, 1887.

The growing point of many ferns is found to be covered with a slimy mucilage which arises from hairs situated on the palæ and the leaves, or where palæ are absent on the leaves only. This mucilaginous secretion serves a most important physiological function, in that it readily takes up and retains water, and thus keeps the young bud moist, and at the same time tends to prevent too excessive transpiration. The cells which secrete the mucilage are large and swollen, and the secretion escapes by the rupturing of the cell wall. We investigated two cases of mucilaginous secretion, viz., *Blechnum occidentale* (L.), where in each hair only the terminal cell is glandular, and *Osmunda regalis* (L.), where usually all the cells of the hair are equally endowed with secretory function. We find that the mucilage arises from the protoplasm only and not from the cell wall, and that the whole process is distinctly intraprotoplasmic. The structure of a mature gland is wonderfully like that of the secretory animal cells investigated by Langley,* and indeed the very words used by him in the description of certain of the secretory cells will quite well apply to the particular glands investigated by us, for we also find that "in the mature cells the cell substance is composed of (*a*) a framework of living substance or protoplasm connected at the periphery with a thin continuous layer of modified protoplasm" (our ectoplasm), and that "within the meshes of the framework are enclosed two chemical substances at least, viz. (*b*), a hyaline substance in contact with the framework, and (*c*) spherical granules which are embedded in the hyaline substance." In our case we have also to add, that the whole cell is enclosed in a cell wall. We find, in other words, that in the glandular cells, investigated by us, mucilage is secreted in the form of drops, and that each drop is further differentiated with a ground substance (gum mucilage) in which are embedded numerous spherical droplets (gum).

The mature cells which we have described are quite full of the secretion, so that the vacuole containing the cell sap has become completely obliterated. This is occasioned mainly by the voluminous character of the secretion, which takes up water and becomes very bulky. The young glands, however, display the usual structure of young cells, each containing a nucleus, plastids (which in the case of *Osmunda* form numerous starch grains), and a vacuole. Secretion

* Langley, 'Cambridge Phil. Soc. Proc.,' vol. 5, p. 25.

commences by the breaking down of a portion of the innermost layers of the endoplasm at a number of contiguous but isolated areas. The result of these katabolic changes in the protoplasm is the formation of small but rapidly growing mucilage drops. The first formation occurs just beneath the free surface, and takes place equally around the whole cell cavity, and the phenomenon steadily continues from within outwards, producing new drops basipetally, and immediately beneath those already formed, until the whole of the endoplasm, together with the substance of the plastids (or starch grains), have taken part in the process, and the cell is now full of isolated drops, each enclosed by a portion of the delicate protoplasmic framework which still remains.

A remarkable sequence of changes occurs in the drops themselves. At their first formation they are watery and by no means well defined. By the use of osmic acid it can then be shown that they contain no tannin. They shortly become denser, and at this stage tannin appears equally distributed throughout their structure. And now in the drops themselves a delicate reticulation may be observed, which finally gives way to the appearance of numerous minute and brightly shining droplets, all separate and distinct, disseminated through the substance of the drop, just as the drops themselves are disseminated through the substance of the protoplasm. Reactions show that the ground substance of the drops is of the nature of a gummy mucilage, while the drops consist of pure gum. Our observations make us disposed to believe that during secretion the protoplasm gives rise to a gummy mucilage, and the latter undergoes further differentiation into a ground substance which still retains its mucilaginous character, and into a gummy substance (a product probably of maximum chemical change) which is present as a number of isolated spherical droplets. In the light of these remarks the structure presented by the mature cell becomes more clear.

In the case of many animal glands, *e.g.*, serous and mucous salivary glands, Langley concludes that the protoplasm forms the hyaline substance, and then out of this manufactures the granules, which during secretion are turned out of the cell and give rise to the particular substance which the gland secretes. The state of active secretion is followed by a resting period during which the protoplasm grows, forms new hyaline substance, and this again produces new granules. We believe that a series of changes essentially similar in character occurs in plant cells also. Usually speaking, plant cells are incapable of such active and repeated secretion as occurs on those of animals, and in many cases, *e.g.*, *Blechnum* and *Osmunda*, the secretion changes occur in the cell once and for all, and at their termination the cell dies. In other instances, however, *e.g.*, the glands of *Dionœa*, it appears exceedingly probable that the phenomena which accompany

the repeated secretion are quite similar to those which happen in so many animal glands.

The various changes which accompany mucilaginous secretion are not shown by *Blechnum occidentale*. In *Osmunda* the drops are much less defined, and, although more numerous, are smaller. The changes which occur in the drops were observed in *Blechnum occidentale*. In *Osmunda* we did not succeed in following them; but since the two glands practically present the same structure in the mature cells, we are led to infer that the various processes are similar in both.

The secretion consisting of the mucilage drops and the disorganised protoplasmic framework escapes by the rupturing of the wall, and the disintegrated nucleus and the endoplasm are the only structures left in the cell.

In *Osmunda* the transverse walls are callussed on both sides, and the whole system (wall and callus plate) is obviously perforated by fine holes, which in the functional cell are filled by delicate strands of protoplasm. These establish a direct continuity between the protoplasmic contents of the various cells of the hair.

We believe that in their main features the phenomena attending the formation of the secretion are such as are very widespread, and limited neither to the ferns nor to the particular case of secretion of mucilage.

II. "On Rabies." By G. F. Dowdeswell, M.A. Communicated by Prof. Victor Horsley, F.R.S. (From the Laboratory of the Brown Institution.) Received May 9, 1887.

(Abstract.)

In this investigation, commenced early in 1885 during the outbreak of rabies in London, the first experiments, made by subcutaneous inoculations with the saliva of rabid street dogs, all failed to produce infection.

Subsequently, adopting the methods described by M. Pasteur, I found—

1. That the virus of rabies and hydrophobia resides in the cerebro-spinal substance and in the peripheral nerves, and is not confined to the salivary glands, as hitherto supposed.

2. That by inoculation of this substance upon the brain of another animal, by trephining, infection follows much more quickly and certainly than by subcutaneous inoculation.

3. That rabies, however produced, in both dogs and rabbits, is essentially a paralytic affection, the same disease in both animals, and